

# SEVEN NEW SPECIES OF *CLIMOCELLA* (GASTROPODA: PUNCTOIDEA: CHAROPIDAE) FROM NORTHERN NEW ZEALAND

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*Abstract.* Seven new species in the charopid genus *Climocella* Goulstone, 1996 are described from the North Island: *Climocella barkeri*, *C. intermedia*, *C. isolata*, *C. waenga* from the East Cape area, *C. mayhillae* from mid Northland, and *C. reinga* and *C. runga* from the Te Pahi area.

In 1992 and 1993 P.C. Mayhill and G.M. Barker surveyed landsnail populations as part of a wider Landcare Research ecological study of the Pukeamaru Ecological District, East Cape. The *Climocella* Goulstone, 1996 material from these collections was given to Auckland Museum. This material consisted of many empty shells from various locations and seven preserved animals from four locations. Additional East Cape shells were also studied from existing Auckland Museum and Museum of New Zealand collections. At first inspection all but three or four shells belonged to the colour patterned group of *Climocella* and, though there were some variations, all were assigned to *Climocella akarana* Goulstone, 1966. The three or four exceptions were unicoloured and belonged to an undescribed species allied to *Climocella kaitaka* Goulstone, 1996. However, dissection of the preserved animals revealed a far from simple situation among the group of patterned shells and it became difficult to view them as one variable species. Seven dissections provided five distinct configurations of genitalia, one of which corresponded to the description of *C. akarana* given by Goulstone (1996) (Te Koau, 2.2 mm. x 1.2 mm, G.B. 24/9/92, AK152164). On re-examination of the fragments of shell from the dissected specimens, linked to whole empty shells from the same sites, three stood out as morphologically separate from *C. akarana*. One additional specimen could be separated from *C. akarana* only with high magnification examination of the conchological features especially the protoconch. These findings, matching features of the shell with that of anatomy, formed the basis of recognition of distinct species amongst the larger collections of empty shell material and their description in this paper. Preserved material is relatively rare in collections and anatomical study of more specimens will no doubt elucidate patterns of anatomical variation within and between *Climocella* species, but for this paper I have separated the material on the basis of the observed anatomical and shell differences.

I have also described a mid Northland unicoloured species from two live specimens and several shells given me by P.C. Mayhill and one shell from F.J. Brook. I have described two northernmost Northland species from preserved material supplied by the Museum of New Zealand, live collected by B.F. Hazelwood and O.J. Marston and many contemporary and subfossil shells in museum collections. One of the latter species was partly illustrated by Climo (1969).

The taxon descriptions and distributions given in this paper are based on specimens held in the Auckland Museum (lot numbers preceded by "AK") and the Museum of New Zealand (lot numbers preceded by "M."). Dissected animal material has been preserved but shell pieces were discarded. For type material the number of specimens is given in parentheses following the accession number. Right hand (R.H.), left hand (L.H.) appearing in the

illustrations refer to the direction of snail locomotion. Collector names, which appear often in the distribution records, are referred to by the following initials: P. Anderson, G. Carlin and C. Ogle (A.-C.-O.), G.M. Barker (G.B.), F.J. Brook (F.B.), F.M. Climo (F.C.), J.F. Goulstone (J.G.), B.F. Hazelwood (B.H.), P.C. Mayhill (P.M.), G.R. Parrish (R.P.), D.J. Roscoe (D.R.). Colours are based on "Ridgways Colour Standards and Nomenclature, 1912" (R.C.S.). Map references are from the N.Z.M.S. 260 series and all dates refer to the 20th century. New Zealand Archaeological Association site record numbers (records with N2/ and N3/ prefixes) and Geological Society of New Zealand fossil record numbers (M02/f prefix) are listed for collections of subfossil specimens.

## SYSTEMATICS

SUPERFAMILY: PUNCTOIDEA Morse, 1864.

FAMILY: CHAROPIDAE Hutton, 1884.

GENUS: *CLIMOCELLA* Goulstone, 1996

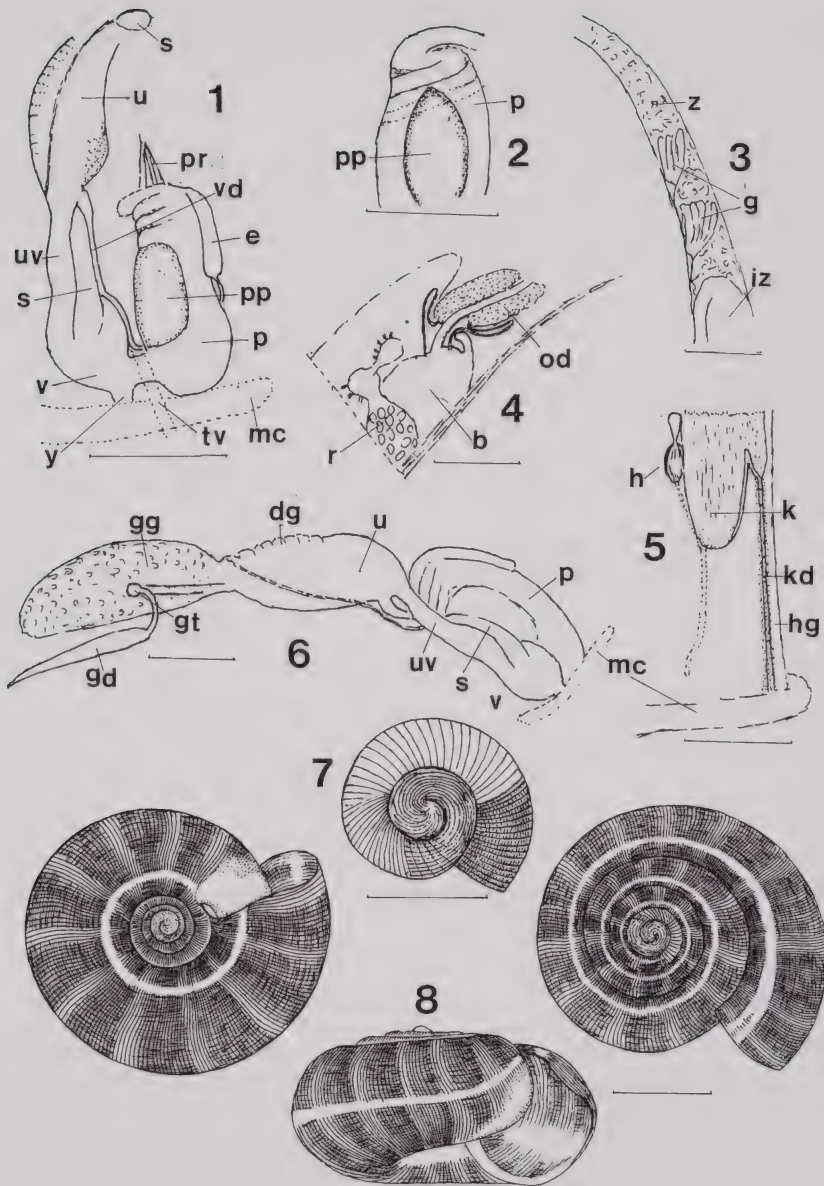
*Climocella barkeri* n. sp. Figs 1-8, 57

ETYMOLOGY: Named for Gary Barker.

## DESCRIPTION

Shell small (up to 2.7 mm x 1.4 mm), subdiscoidal, four and a quarter whorls, first two narrow, last somewhat inflated (0.8 mm, nearly one third of diameter). Spire flat or slightly raised, umbilicus one quarter shell width. Protoconch one and three quarter whorls, first whorl with nine spiral lirae, second quarter with fine crowded oblique axials, third half having less oblique more distant axials (40 per mm). Teleoconch whorls have close axial ribs (95 per mm on first, 31 per mm on the last whorl) with three or four very fine secondary axials between. These axials, emerging at right angles from a moderately deep suture, are slightly sinuous. The whole surface is overlaid with fine close microscopic spiral lirae. Colour consists of indistinct, broad, radial bands of sepia (pl.29 17m R.C.S.) against a cartridge buff (pl.30 19f R.C.S.) background, the markings quite faint on base. (This description is of the holotype.)

Ovotestis comprising two clusters of alveoli (0.35 mm & 0.27 mm), with digestive gland tissue between, extending from just beyond apex of stomach and start of intestine. Hermaphrodite duct emerging as a fine tube from ovotestis, with enlarged medial section (0.8 mm long) slowly widening then abruptly narrowing for a short section before entering albumen gland. Albumen gland under loops of intestine has talon (0.2 mm diameter) imbedded near centre and spermathecal sac touching distal edge. Spermoviduct oval (1 mm long) with prostatic portion on proximal section, narrows to oviduct (0.6 mm long). Vagina bulbous (c. 0.5 mm x 0.5 mm). Spermathecal duct long, its widened base arising from the vagina is same length and width as oviduct, its greater distal length adjacent to spermoviduct very slender terminating in small spheroidal reservoir. Penis in proximal part rectangular in outline, broad (1.5 mm x 0.6 mm), extending distally as a narrowed tube to atrium. Epiphallus a straight tube (about 0.7 mm long) external to penis, in distal part apparently as coils fused to apex of penis. Retractor muscle attached apically to these coils. Penis has internal, solid, tear shaped stimulatory organ, clearly visible through the walls. Kidney bilobed, that lobe abutting rectum small. Some scattered black pigment on pallial membrane along length of ureter. White stringy pigmentation along



Figs 1-8. Shell and anatomy of *Climocella barkeri* n. sp. Scale lines 1,2,5,8 = 1 mm, 3,4,6,7 = 0.5 mm. Abbreviations: b - buccal mass, be - oesophagus, dg - prostatic gland, e - epiphallus, ep - pore from epiphallus into penis, g - ovotestis, gd - hermaphrodite duct, gg - albumen gland, gt - talon, h - heart, hg - hindgut, i - intestine, iz - stomach, k - kidney, kd - ureter, mc - mantle collar, og - salivary glands, od - salivary ducts, p - penis, pi - pigmentation, pp - penis pilaster or stimulator, pr - penis retractor muscle, r - ganglia, s - spermathecal shaft and its sac, u - spermoviduct, tv - rhinophoral tentacle, uv - free oviduct, v - vagina, vd - vas deferens, y - genital atrium, z - digestive gland. 1. Terminal genitalia. 2. Penis. 3. Digestive gland and ovotestis. 4. Salivary glands, buccal mass and ganglia. 5. Pallial cavity and kidney. 6. R.H. view of genitalia. 7, 8. Shell and protoconch of holotype (AK72891).

length of stomach. (Anatomy based on one dissection from the East Cape Lighthouse Reserve, 2.8 mm x 1.4 mm, G.B. 20/9/92, AK152165.)

#### REMARKS

The narrow first initial whorls, with the inflated final whorl distinguish this species. Even juveniles of three whorls showed this feature. A dissected juvenile specimen from Mt. Hikurangi Hut (2.2 mm x 1.3 mm, P. Poortman 8/4/96 AK152166) had not developed sufficient recognisable genitalia.

TYPE LOCALITY: East Cape Lighthouse Reserve, Z14 992754.

HOLOTYPE: Auckland Museum AK72891, 2.7 mm x 1.4 mm., G.B. 20/9/92.

PARATYPES: All from type locality. AK72892, G.B. 20/9/92 (1 ad., 2 juv.); AK72893 in manuka and flax litter, G.B. 20/9/92 (1 ad., 4 juv.); AK72937, P.M. 1/6/96 (7); M.129901, G.B. 20/9/92 (2 ad., 4 juv.).

#### OTHER MATERIAL EXAMINED

Anaura Bay Z16 743163, P.M. 1/4/94, AK151757. East Cape Z14 991754, P.M. 1/10/82, AK151792; Z14 991752, L. Daniel 1/1/85, M.76364, M.76398. Hicks Bay Z14 774900, P.M. 1/3/93, AK151749; Z14 777867, P.M. 1/12/77, AK151885. Hikurangi Hut Y15 547538, P.M. 1/12/80, AK151802, M.76802. Kopuapounamu Valley Z14 815781, F.C. 19/5/83, M.78033. Maungamauku Z14 817741, F.C. 19/5/83, M.78301. Papatea Y14 385806, G.B. 14/9/92, AK151778. Rangiata Z14 762986, G.B. 20/9/92, AK151774. Rereauria Y14 582906, G.B. 20/9/92, AK151777. Taikawakawa Z14 931806, G.B. 21/9/92, AK151775. Te Araroa Z14 852828, P.M. 1/2/81, AK151760; Z14 790857, D.R. 28/12/79, M.102976. Te Kaha X14 290713, P.M. 1/7/86, AK151913. Te Koau Z14 778864, P.M. 1/3/93, AK151807; Z14 778862, G.B. 23/9/92, AK151776. Tikitiki Z14 937707, D.J.R. 8/7/78, M.104105. Waenga: Y14 653913, P.M. 1/9/92, AK151828; Y14 652913, G.B. 16/9/92, AK151773. Waiaroho: Y14 656865, P.M. 1/3/93, AK151772; Y14 651866, P.M. 1/9/92, AK151764.

#### DISTRIBUTION AND HABITAT

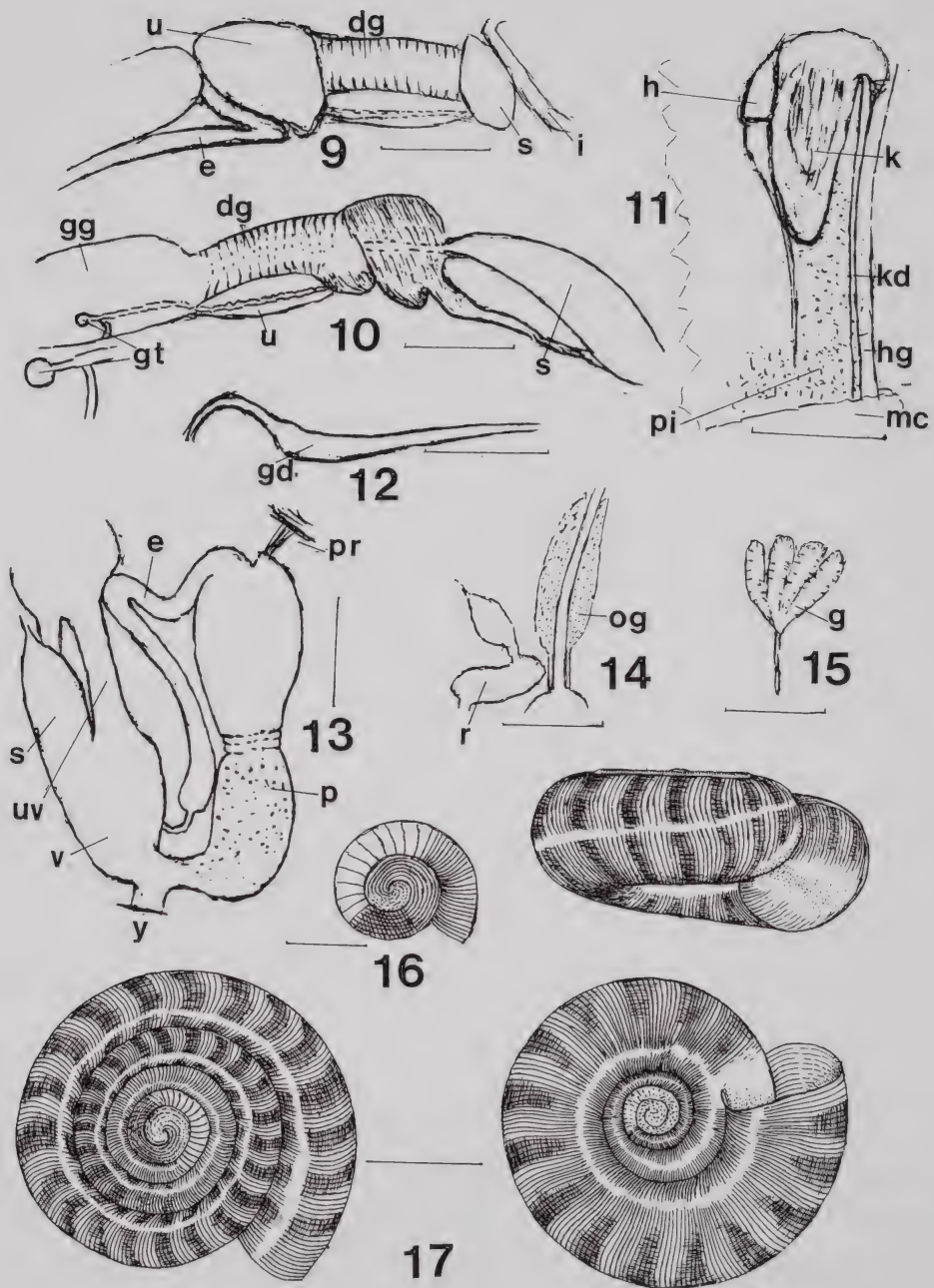
Known from a number of sites between Papatea in the west to East Cape, and also south to Hikurangi and Anaura Bay. Generally found in forest but at the East Cape Lighthouse Reserve occurs in scrubby open conditions in native grasses and fine sedge (P.M., pers. comm.).

#### *Climocella intermedia* n. sp. Figs 9-17, 57

ETYMOLOGY: This snail appears intermediate between *C. akarana* and *C. waenga*.

#### DESCRIPTION

Shell small (up to 2.7 mm x 1.3 mm), subdiscoidal, four and a quarter regularly increasing whorls (final whorl between a quarter and a fifth of diameter). Spire flat or slightly sunken, umbilicus just less than one third diameter. Protoconch one and three quarter whorls; first whorl with eight spiral lirae; second quarter of protoconch with about 12 crowded oblique



Figs 9-17. Shell and anatomy of *Climocella intermedia* n. sp. Scale lines 11, 17 = 1 mm, 9, 10, 12-16 = 0.5 mm. Abbreviations as for Figs 1-8. 9. L.H. view spermoviduct with position of spermathecal sac. 10. R.H. view of spermoviduct, albumen gland and talon. 11. Pallial cavity and kidney. 12. Hermaphrodite duct. 13. Terminal genitalia. 14. Salivary glands. 15. Ototestis. 16, 17. Shell and protoconch of holotype (AK72894).

radials over the eight spirals; third half with quite wide straight axials (42 per mm) without spirals. Teleoconch whorls have close axial ribs (85 on first 27 per mm on last whorl) with three very fine secondary axials between. Ribs slightly oblique from moderately deep suture, forward in direction of growth. Teleoconch with fine, close microscopic spirals, more prominent than secondary axials in the interstices. Colour consists of narrow radial bands of amber brown (pl.3 13k R.C.S.) on a cartridge buff (pl.30 19f R.C.S.) background, more prominent on outer whorls and proceeding over base to umbilicus. (Description based on holotype.)

Ovotestis comprising two clusters of alveoli with digestive gland tissue between extending from just beyond apex of stomach and start of intestine. Hermaphrodite duct a fine tube arising from ovotestis, with enlarged tapered medial section (1 mm long), reducing sharply to short narrow tube terminating in carrefour with diverticulate talon (0.1 mm diam.) partially embedded in albumen gland. Albumen gland under loops of intestine. Spermoviduct, elongate (1.1 mm long) with prostatic portion (0.6 mm long) in proximal section, narrows to free oviduct (0.7 mm long). Vagina bulbous (0.7 mm long). Spermathecal duct, with thicker base same length as free oviduct but twice as wide, narrowing to very slender distal section running adjacent to spermoviduct to terminate in spermathecal reservoir sac lying beside albumen gland. Epiphallus long (1.25 times penis length), folded in retracted position. Penial retractor muscle inserted on proximal apex of penis adjacent to epiphallus entry. Penis, oval shaped (1.6 mm long) with restricting rings near middle; proximal portion thick and opaque, distal portion translucent, narrowed to atrium. Kidney weakly bilobed the limb adjacent to rectum very small. Outside wall of pallial cavity has speckled black pigmentation, broad at mantle collar, narrowing along line of ureter. (Anatomy based on one specimen from Papatea, 2.75 mm x 1.4 mm, G.B. 14/9/92, AK152167.)

## REMARKS

This species closely resembles the variable *C. akarana* in shell features, particularly *C. akarana* from Auckland. Shells of East Cape *C. akarana* are always slightly domed with crowded oblique protoconch radials merging straight into true teleoconch axials, whereas *C. intermedia* has a flat or slightly depressed spire and the addition of straight widely spaced axials on the protoconch. Strong differences in terminal genitalia also separate *C. intermedia*.

TYPE LOCALITY: Papatea Y14 385807, 60 m.

HOLOTYPE: Auckland Museum AK72894, 2.65 mm x 1.25 mm, P.M. 1/9/92.

PARATYPES: All from type locality. AK72895, P.M. 1/3/93 (5 ad., 5 juv.); M.129902, P.M. 1/9/92 (6 ad., 4 juv.).

## OTHER MATERIAL EXAMINED

Motu R. X15, A.E. Brookes, AK85669; X15 165607, P.M. 1/12/80, AK151804; X15 177607, P.M. 1/12/80, AK151819. Ohinepoutea St. Y15 585596, F.C. 12/5/83, M.78250. Papatea Y14 385807, P.M. 1/3/93, AK151751; P.M. 1/9/92, AK151746. Raukokore Y14 405837, D.R. 10/7/78, M.104021. Te Kaha X14 266735, P.M. 1/10/82, M.76841; 1/7/86, M.87641; X14 290713, P.M. 1/7/86, AK151912. Te Puia Y14 483819, P.M. 1/3/93, AK151801. Waihau Bay Y14 440860, A.W.B. Powell 1/8/33, AK85607. Waiotahi R. W16 761289, L. Daniel 1/1/85, M.82499.

## DISTRIBUTION AND HABITAT

*C. intermedia* is plentiful at some eastern Bay of Plenty forest sites and also occurs in forest at the end of the Mt. Hikurangi road. Its present known western limit is at Waiotahi River west of Opotiki. Although it is sympatric with *C. barkeri* at several sites it did not overlap with *C. waenga*. Found in fine friable soil under fallen logs and in crevices in bark on fallen logs (P.M., pers. comm.).

***Climocella isolata* n. sp. Figs 18-25, 57**

ETYMOLOGY: On present evidence this snail appears isolated around the East Cape.

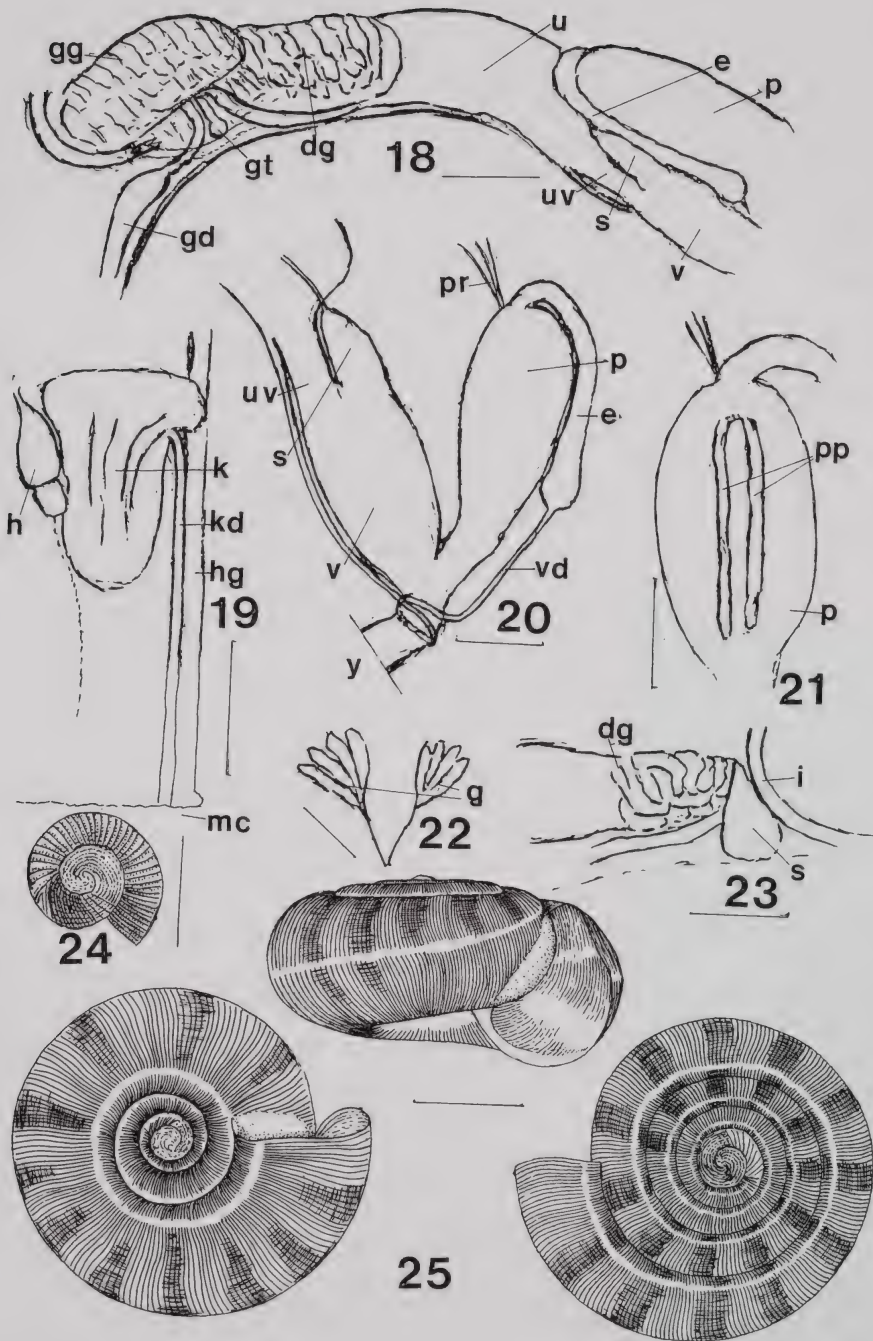
## DESCRIPTION

Shell small (up to 3.0 mm x 1.5 mm), subdiscoidal, with four and a quarter whorls (final whorl 0.78 mm, one third to one quarter diameter). Spire slightly raised, umbilicus 0.3 of shell diameter. Protoconch small, one and three quarter whorls; first whorl with seven spiral lirae; second quarter with fine oblique axial lirae (up to 17) crossing the spirals; third half with stronger straighter lirae free of spirals (about 34 per mm). Teleoconch whorls have close axial ribs (95 on first, 36 per mm on last whorl), with one or two barely discernable secondary ribs between. These axials arise at right angles from a moderately deep suture and are slightly sinuous past the shoulder of the whorl. The whole surface plus the first half of the protoconch is overlaid with fine, close microscopic lirae. Colour consists of indistinct radial bands of amber brown (pl.3 13k R.C.S.) against a cartridge buff (pl.30 19f R.C.S.) background, these bands discernable right into umbilicus.

Ovotestis comprising two clusters of alveoli (0.5 mm long) with digestive gland tissue between positioned just beyond stomach and intestine entry. Hermaphrodite duct a fine tube arising from ovotestis with enlarged tapered medial section, reducing to short narrow tube entering albumen gland. Albumen gland a dense crenellated oval organ into which hermaphrodite duct enters distally alongside a protruding carrefour with diverticulate talon and proximal spermoviduct tube. Spermoviduct contains a dense prostatic portion (about one third length of spermoviduct) abutting albumen gland. Pear shaped spermathecal sac (0.5 mm long) resting on intestine loop. Free oviduct short (one third length of vagina). Proximal spermathecal duct same width and length as free oviduct. Vagina rather broad (equal to combined width of free oviduct and proximal spermathecal duct). Vas deferens completely encircles short atrium chamber. Epiphallus, nearly same length as penis, slightly bulbous at union with vas deferens. Penis retractor muscle attached to apex of penis adjacent epiphallus entry. Penis club shaped (1.95 mm long) with two long pilasters. Kidney (1.6 mm long) weakly bilobed the limb overlying the rectum very small. (Anatomy based on one specimen from the East Cape Lighthouse reserve, 3.0 mm x 1.5 mm, G.B. 20/9/92 AK152168.)

## REMARKS

At the East Cape Lighthouse Reserve *C. isolata* and *C. barkeri* were the only *Climocella* species collected. Shells of adult mature animals were easy to separate but specific differentiation of a large number of juveniles was difficult. The narrower final whorl of the mature shell (by comparison with *C. barkeri*) provided the best character for specific identification



Figs 18-25. Shell and anatomy of *Climocella isolata* n. sp. Scale lines 19,25 = 1 mm, 18,20-24 = 0.5 mm. Abbreviations as for Figs 1-8. 18. R.H. view of genitalia. 19. Pallial cavity and kidney. 20. Terminal genitalia. 21. Penis pilasters. 22. Ovotestis. 23. Position of spermathecal sac. 24, 25. Shell and protoconch of holotype (AK72896).



at the type locality. Specimens collected in the Kopuapounamu Valley also had a final whorl noticeably narrower than any other *Climocella* in the area.

TYPE LOCALITY: East Cape lighthouse reserve, Z14 992754.

HOLOTYPE: Auckland Museum AK72896, 3.0 mm x 1.5 mm, G.B. 20/9/92.

PARATYPES: Type locality AK72897, G.B. 20/9/92 (1 ad. damaged, 4 juv.); AK72936, P.M. 1/6/96 (1); M.77974 mamaku and broadleaf Z14 991752, F.C. 19/5/83 (3 ad., 4 juv.).

#### OTHER MATERIAL EXAMINED

East Cape, Otiki Res. Z14 992754, G.B. 20/9/92, AK151779, AK151780. East Cape Z14 990754, N. Douglas 8/4/77, AK85637. Kopuapounamu Valley. Z14 815781, F.C. 19/5/83, M.78033.

#### DISTRIBUTION AND HABITAT

Several locations around the East Cape lighthouse and further west in the Kopuapounamu Valley are the only known locations for *C. isolata*, but as the high country between the locations has not been sampled it will probably be found living there also. Even so the present known range is extremely limited. *C. isolata* was found in grass and sedge at East Cape and at Kopuapounamu under sparse kahikatea amongst grass (P.M., pers. comm.).

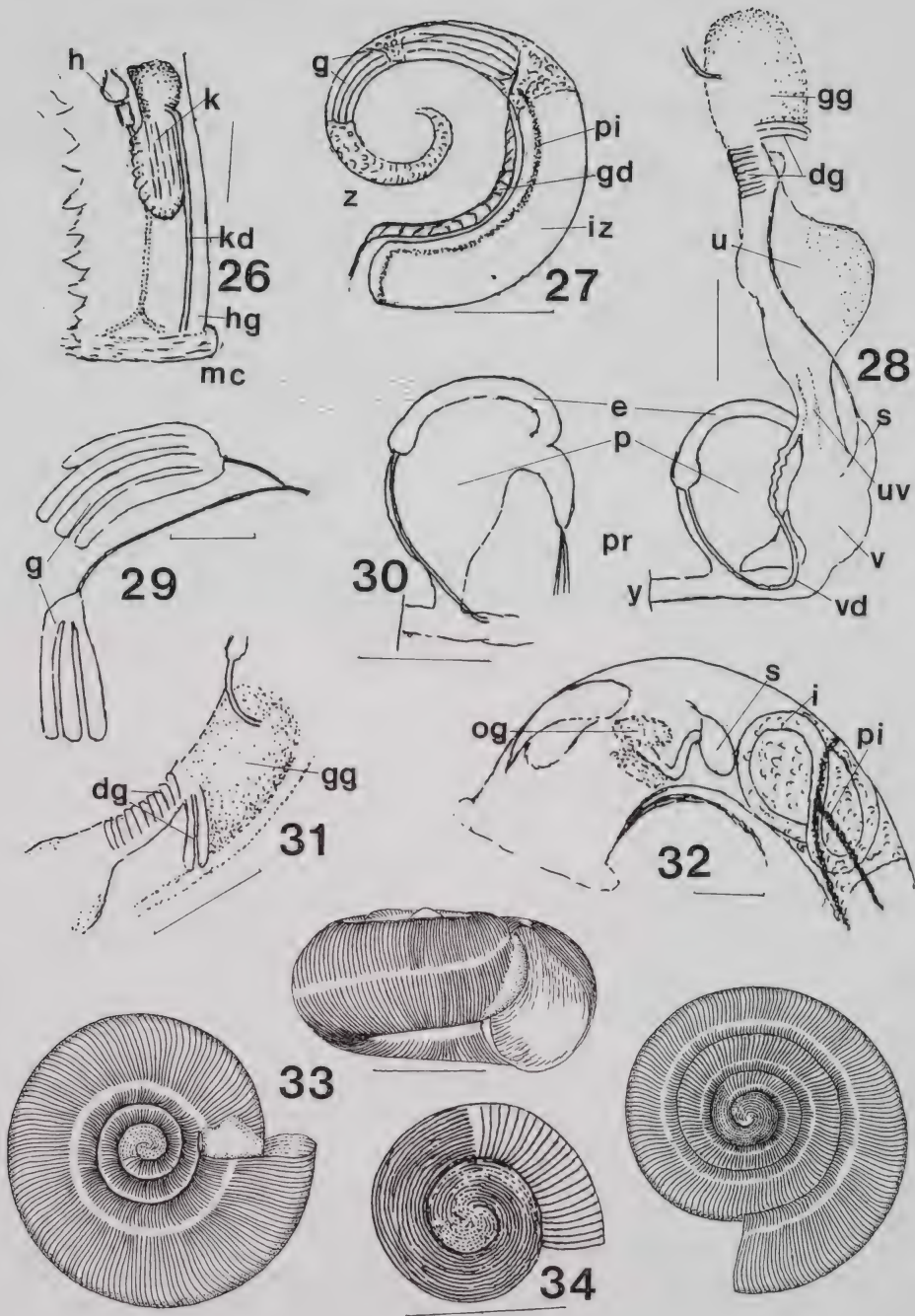
#### *Climocella mayhillae* n. sp. Figs 26-34, 57

ETYMOLOGY: Named for Pauline Mayhill.

#### DESCRIPTION

Shell small (up to 2.7 mm x 1.4 mm), subdiscoidal, four regularly increasing whorls, the last, 0.2 of total diameter. Spire flat, umbilicus 0.3 of total shell diameter. Protoconch with one and three quarter whorls; first one and a quarter whorls with nine spiral lirae; next half whorl with straight distant axials (27 per mm). Teleoconch whorls have close axial ribs (106 on first 23 per mm on last whorl) with no discernable secondary ribs between. These axials rise from a deep suture, angled in direction of growth over shoulder and top of shell, sweeping back near the perimeter towards umbilicus. Surface, including last half of protoconch, covered with strong, close, microscopic spirals. Shell unicoloured, Dresden brown (pl. 15 17k R.C.S.) when fresh. (The shell size given is of the dissected specimen. Other details relate to the holotype which is smaller.)

Ovotestis consisting of two long clusters of alveoli (1.17 mm and 0.9 mm), with some digestive gland tissue between, occupying nearly the whole width of the viscera just behind stomach apex. Hermaphrodite duct comprising a short fine tube arising from ovotestis and long enlarged section (1.5 mm) to albumen gland. Prostate gland in two portions, two long separate structures immediately under the albumen gland and a short section of alveoli fused to the proximal part of the spermooviduct. Distal portion of spermooviduct (0.8 mm) translucent and bulbous on one side. Free oviduct short (0.4 mm). Vagina longer (0.6 mm), bulbous. Spermathecal duct with a thickened base half width of free oviduct, continued as a slender tube adjacent to spermooviduct to a sac lying beside albumen gland. Penis globular (1 mm long),



Figs 26-34. Shell and anatomy of *Climocella mayhillae* n. sp. Scale lines 33 = 1 mm, 26-32, 34 = 0.5 mm. Abbreviations as for Figs 1-8. 26. Pallial cavity and kidney. 27. ovotestis, stomach and hermaphrodite duct. 28. R.H. view of genitalia. 29. Ovotestis. 30. Penis. 31. Prostatic gland. 32. Position of spermathecal sac. 33,34. Shell and protoconch of holotype (AK72898).

with a tubular caecum at its apex to which attaches the penial retractor muscle. Epiphallus, half length of penis entering at base of caecum. Kidney weakly bilobed, verge of long lobe slightly crenellated. Upper membrane of pallial cavity with considerable black pigmentation. (Based on one dissection from Ngaiotonga, 2.7 mm x 1.4 mm, P.M. 1/3/96 AK152169, and one from Drinnan Rd., Parakao, 2.5 mm x 1.2 mm, P.M. 1/5/96 AK152170.)

#### REMARKS

This animal is quite distinctive and is unlikely to be confused with other *Climocella*. The brown shell is similar to some *C. reinga* which have, however, much closer ribbing. *C. mayhillae* is not common, and material from the sites of the dissected snails was scarce. The Parakao specimen dissected was not yet fully adult, the separate, proximal, prostatic alveoli still coiled and the spermoviduct partly collapsed. The black pigmentation over the pallial cavity was stronger on the younger snail.

TYPE LOCALITY: Ngaiotongo State Forest, 140 m Q05 237545.

HOLOTYPE: Auckland Museum AK72898, 2.5 mm x 1.25 mm, P.M. 1/3/96.

PARATYPES: AK72899, Ngaiotonga S.F. 110 m Q05 231546, P.M. 1/4/81 (1); M.129903, Ngaiotonga viewpoint 120 m Q05 238545, P.M. 1/4/81 (1).

#### OTHER MATERIAL EXAMINED

Bland Bay Islet Q05 350497, F.B. 26/3/96, AK151861. Glenbervie S.F. Q06 344197, P.M. 1/11/86, M.98265. Harrison Res. Q05 114545, P.M. 1/11/88, AK151670. Moturoa Is. Q05 094648, P.M. 1/1/90, AK151723. Ngaiotonga Q05 231546, P.M. 1/4/81, AK151666; Q05 237545, P.M. 1/3/96, AK151667. Parakao, Drinnan Rd. P06 988141, P.M. 1/9/84, AK151722. Puketū P05 704626, P.M. 1/12/81, M.78648. Puketotara Rd. P05 896616, P.M. 1/11/87, AK151669. Te Ringa Tr. Q05 256520, P.M. 1/11/88, AK151671. Utakura P05 714474, P.M. 1/11/87, AK151668. Waipapa Tr. P05 827659, P.M. 8/11/89, M.114428.

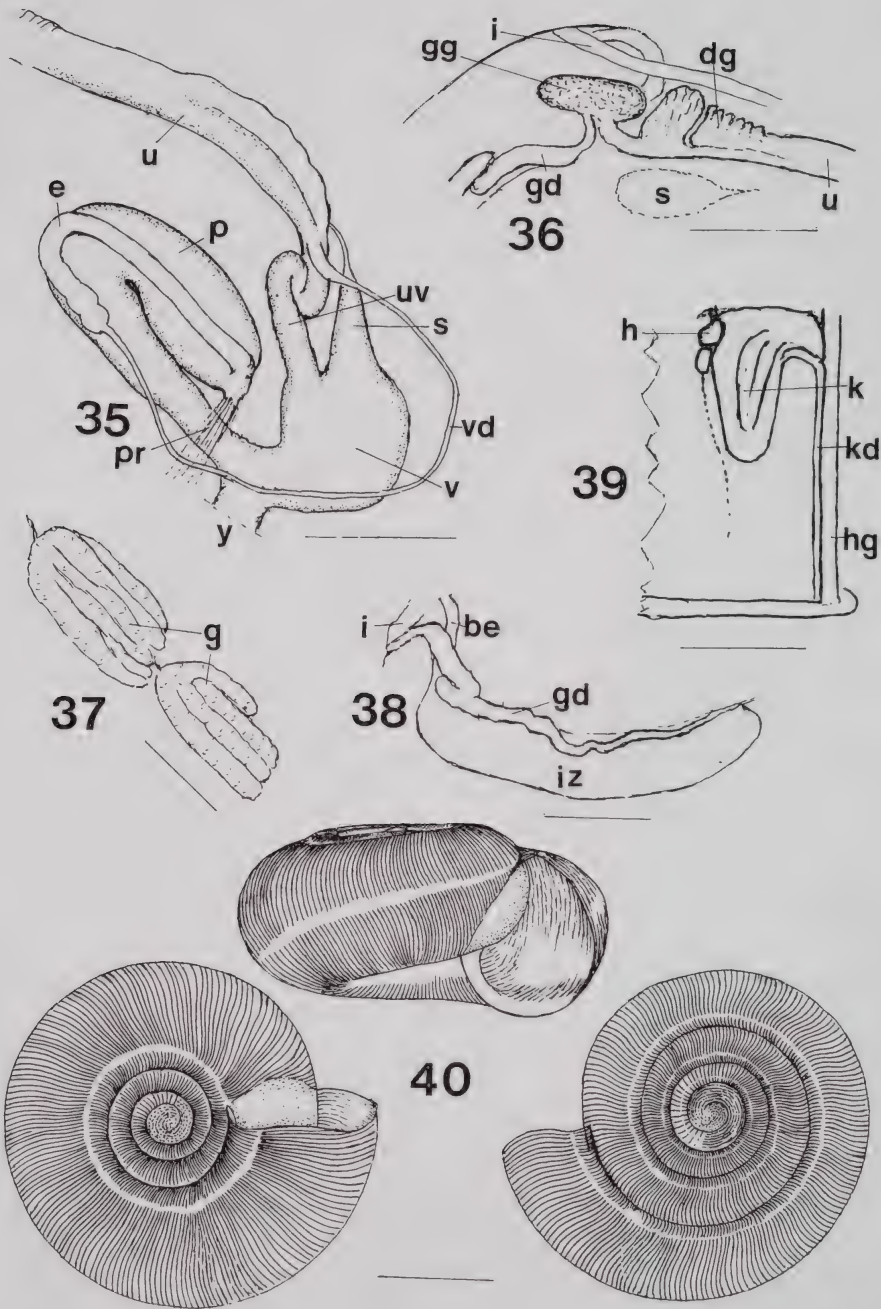
#### DISTRIBUTION AND HABITAT

This species occurs in a band across mid Northland but is patchily distributed. It was found most abundantly in coastal broadleaf-podocarp forest in Harrison Reserve in the Bay of Islands. All the other sites produced only one or two specimens each. The live snail dissected from the type locality was found under rimu bark on the ground.

#### *Climocella reinga* n. sp. Figs 35-40, 57

*Mocella cogitata* Iredale: Gardner (1967) (in part). *Trans. Roy. Soc. N.Z., Zoology*, 8(21):219. *Charopa (Mocella) eta* (Pfr): Climo (1970) (in part). *Rec. Dom. Mus.* 6(18):314. "*Mocella*" cf. *manawatawhia*: J.F. Goulstone, P.C. Mayhill and G.R. Parrish (1993). *Tane* 34:11.

ETYMOLOGY: Named after Cape Reinga.



Figs 35-40. Shell and anatomy of *Climocella reinga* n. sp. Scale lines 40 = 1 mm, 35-39 = 0.5 mm. Abbreviations as for Figs 1-8. 35. Genitalia to albumen gland. 36. Albumen gland and hermaphrodite duct. 37. Ovotestis. 38. Hermaphrodite duct. 39. Pallial cavity and kidney. 40. Shell of holotype (M.129904).

## DESCRIPTION

Shell small (up to 2.9 mm x 1.5 mm), subdiscoidal, four and a quarter regularly increasing whorls, the last, one quarter of total diameter. Spire flat to slightly convex, umbilicus 0.3 of shell diameter. Protoconch one and three quarter whorls; first with six spiral lirae, last three quarters with straight axials only (c. 27), distant at first, close near teleoconch. Teleoconch whorls have close axial ribs (88 on the first, 23 per mm on final whorl), and three or four extremely fine secondary axials in interstices, dominated however by strong crowded microscopic spirals covering the main axials and extending onto last three quarters of protoconch. Axials from moderate suture, undulating over whole surface. Colour uniformly Mars brown (Pl. 15, 13M, R.C.S.). (Based on the holotype.)

Ovotestis comprising two long, thin clusters (0.8 mm & 0.6 mm long) of alveoli extending horizontally from just past apex of stomach and surrounded by digestive gland tissue. Hermaphrodite duct a fine tube arising from ovotestis gradually thickening for 0.8 mm then narrowing to enter albumen gland. Albumen gland small. Spermoviduct (0.7 mm long), no more than a thick tube with a small proximal bulge containing a segment of prostatic gland. Free oviduct a continuation of this tube (0.2 mm), leads to bulbous vagina and base of spermathecal duct. Spermathecal duct with opening twice width of free oviduct, tapering rapidly to a fine tube; spermathecal sac resting over a loop of intestine close to albumen gland. Penis elongate (1.25 mm. long), folded, proximal half a solid oval organ with retractor muscle attached apically alongside epiphallus entry, distal half a thick tube. Epiphallus an elongate tube slightly bulbous at entry of vas deferens. Kidney bi-lobed with longer pericardial lobe (0.8 mm) placed some distance from ureter and hindgut. (Based on two dissected animals from type locality, Tapotupotu: 2.2 mm x 1.2 mm, F.C. 30/4/68, AK152228; 2.7 mm x 1.4 mm, B.F. Hazelwood and O.J. Marston 5/6/96, AK152171).

## REMARKS

The specimens dissected from 1968 collections had white shells but live and freshly dead specimens from the same site collected in 1996 were brown. All old specimens (more than five years) in museum collections were bleached. It seems that empty shells from forest locations bleach white very quickly whereas specimens from shrubland, such as those at Herangi, remain brown longer. Although many of the shells seen had a flat spire, some, including the hundreds of sub-fossil specimens from the Aupouri sand dune archaeological sites, had a slightly raised spire. Variations in rib density, even amongst specimens from the same site, were noticed but no measurements taken. I dissected an animal from Dr Climo's 1968 preserved material and found the anatomy essentially as he depicted (Climo 1969). I have, however, illustrated a specimen collected by Hazelwood and Marston in 1996 which was larger and more mature. This specimen had a brown shell, thicker vagina and more developed prostatic gland than the Climo material.

TYPE LOCALITY: Junction of Cape Reinga Rd. and Tapotupotu Rd., M02 838512.

HOLOTYPE: Museum of New Zealand M.129904, 2.9 mm x 1.5 mm, B. Hazelwood and O.J. Marston 5/6/96.

PARATYPES: All from type locality. M.129905, F.C. 30/4/68 (1), M129906, B.F. Hazelwood

and O.J. Marston 5/6/96 (2 adults, 1 juv.), AK72900, B.F. Hazelwood and O.J. Marston 5/6/96 (10), AK72901, B.F. Hazelwood and O.J. Marston 5/6/96 (2 whole organisms).

## OTHER MATERIAL EXAMINED

### *Subfossil*

Aupouri sand dune archaeol. study N02 942356, N2/876, M.74070; N03 074226, N3/582, M.77274; N03 126140, N3/455, M.74040; N03 056201, N3/499, M.74059; N02 960323, N2/823, M.87699; N03 051196, N3/156, M.74019; N03 056201, N3/499, M.74013; N03 120153, N3/823, M.74675 - all R. Wallace 1980. N03 125136, N3/450, J. Coster 1981, M.70435. Taupiri Is. Holocene subfossil M02 792469, M02/f76, F.B. & J. McCallum, AK91777. Te Werahi Holocene subfossils M02 811484, M02/f86, AK101147; M02 813483, M02/f89, AK91673; M02 788473, M02/f75, AK91722; M02 802478, M02/f105, AK99946; M02 796481, M02/f101, AK92167; M02 816497, M02/f111, AK99994; M02 786475, M02/f99, AK91851; M02 797472, M02/f77, AK91759; M02 799479, M02/f100, AK100006 - all F.B. 1/10/93. M02 800478, M02/f81, AK91833; M02 799473, M02/f78, AK91825, F.B. & C. Laurenson 24/1/95.

### *Contemporary*

Cape Maria van Diemen, paraspiritus colony M02 797472, M.99449; M02 786473, M.99429, R.P. 27/9/88; P.R. Jamieson 1/9/76, M.88669; B.H. & O.J. Marston 7/6/96, M.124283. Consobrinus colony, Cape Maria van Diemen, B.H. 2/1/76, M.70082. Cape Reinga M02 818532, F.B. 4/6/94, AK89348. Darkies Ridge M02 879503, R.P. 20/10/89, M.16168. Great Exhibition Bay N03 179204, N. Douglas 24/5/71, AK152044. Haupatoto N02 068486, A.-C.-O. 4/3/85, M.77002; N02 065488, P.M. 1/3/88, AK152018. Herangi M02 811478 AK92151, M02 812478 AK151937, F.B. 1/10/93; Kerr Point, near *P. watti* colony N02 101549, D.R. 8/10/76, M.56354. Kohuronaki N02 966448, M.79617; N02 969449, M.79651, A.-C.-O. 1/7/84; N02 966449, G. Carlin 1/7/84, M.79641. Maungapika N02 983534, R.P. 28/7/88, M.99457, J.G. 11/5/91, AK97612. Mokaikai N02 099480, P.M. 1/3/88, AK152020. Motuopao Is. M02 778480, R.P. 29/7/88, M.89821. Muriwhenua N02 068519, P.M. 1/10/88, AK152005; N02 067520, P.M. 1/3/88, AK152012; N02 073518, P.M. 1/10/88, AK152021. Mt. Camel N03 258088, R.P. & K. Walker 26/3/88, M.96556; B.H. 4/1/76, M.47294; P.R. Jamieson 12/1/75, M.88460. Ngatuiiau Str. N02 043530, A.-C.-O. 1/11/86, M.87873. Pandora M02 897483, D.R. 29/12/78, M.103945; N. Gardner 2/1/50, AK85688; M02 896498, P.M. 1/10/88, AK152025. Pandora Rd., F.C. 5/9/71, M.38246, M02 888488; 8/3/67, AK85687. Ponaki Str. N02 086463, A.-C.-O. 1/11/86, M.87836. Radar Bush M02 897476, P.M. 1/4/83, M.79325 AK152009; N02 897476, P.M. 1/5/82, AK152016. Spirits Bay N02 993521, P.M. 1/5/82, AK152015. Spirits Bay - Te Hapua junction N02 966449, A.-C.-O. 4/3/85, M.81779; N02 995448, P.M. 1/10/86, M.97258; N02 997452, P.M. 1/10/86, AK152017; N. Douglas 25/5/71, AK151930, 13/5/73, AK85686. Tapotupotu M02 845518, B.H. & O.J. Marston 5/6/96; M02 837511, O.J. Marston, M.76589; M02 853516, N. & L. Douglas 1/6/69, AK151863. Tapotupotu Tr., B.A. Holloway 3/12/60, M.38291; M02 879484, P.M. 1/3/88, M.116614 AK152003. Tawekaweka Str. N02 104537, A.-C.-O. 5/3/85, M.77047. Te Hapua Rd. N02 003450, N. Douglas 25/5/71, AK151862; N02 997452, P.M. 1/3/96, AK151678. Tom Bowling Bay N02 073519, P.M. 1/5/85, M.82062; N02 075520, P.M. 1/10/86, AK152013; N02 067503, B.H. 7/10/76, M.55452, M.72444. Taumataroa Flat N02 064494, R.P. 17/3/88, M.99109; N02 056497, P.M. 1/3/88, AK152008. Unuwahao N02 009522, M.87735, N02 009518, M.87917, N02 006520, M.87947, A.-C.-O. 1/11/86; N02 125240, P.M. 1/4/83, M.79028; N02 014522, P.M. 1/10/88, AK152011; 1/5/82, M.79370; N02 017518, P.M. 1/5/82, AK152007; 260m, A.W.B. Powell 1/2/32, AK25715; N02 009522, AK151936, N02 013523, M.124286, B.H. & O.J. Marston 6/6/96. Waihi Str. N02 005527, J.G. 10/5/91, AK97125. Waterfall Gully N02 991525, AK85685. Whareana N02 106487, A.-C.-O. 5/3/85, M77024.

## DISTRIBUTION AND HABITAT

*C. reinga* is present throughout the Te Pahi region and at least as far south as Mt. Camel living both in broadleaf forest and shrubland. It is also a characteristic species in Holocene dune snail faunas in the Te Werahi area (F. Brook, pers. comm.), and is extremely abundant in some archaeological dune sites on Aupouri Peninsula (R. Wallace, pers. comm.).

*Climocella runga* n. sp. Figs 41-48, 57

ETYMOLOGY: Derived from Maori, *runga* = above, top.

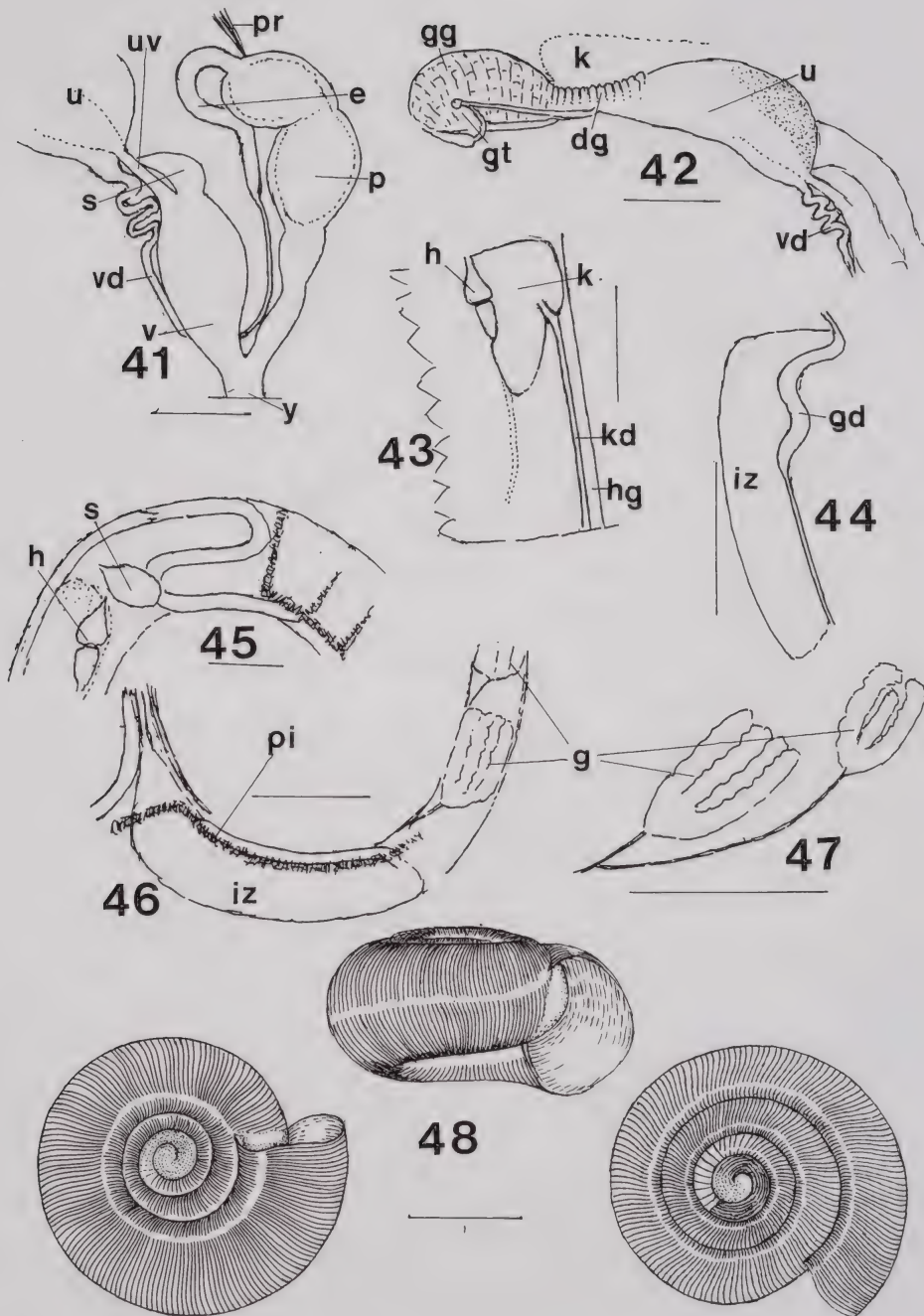
## DESCRIPTION

Shell small (up to 2.4 mm x 1.3 mm), subdiscoidal, four whorls, first two narrow and depressed, third expanded and raised, fourth expanded and dropping. Final whorl 0.27, umbilicus 0.34 respectively of total shell diameter. Protoconch one and a half whorls, first one and a quarter whorls with six spiral lirae, last quarter with ten solid distant axials (27 per mm) slightly oblique in direction of growth. Teleoconch whorls have tall rectangular axial ribs (72 on first, 27 per mm on last whorl), with three or four fine secondary axials between; these ribs arise from a deep suture at a strong oblique angle in the direction of growth but once over the shoulder the angle lessens. Microscopic spirals though present are hardly visible at 20x magnification except as faint crenellations on top of ribs. Unicoloured, cream buff (pl.30 19d R.C.S.). (Based on the holotype.)

Ovotestis comprising two clusters of alveoli (the longer one 0.4 mm, and 0.4 mm from stomach apex). Both separated by digestive gland tissue but taking up nearly all the visceral space. Hermaphrodite duct a thin tube arising from ovotestis with medial enlarged section (0.5 mm long), reducing to short thin section terminating in carrefour and diverticulate talon embedded near apex of albumen gland. Distal portion of hermaphrodite duct surrounded by stomach tissue. Albumen gland oval (0.8 mm). Spermoviduct, proximal portion with prostatic gland, distal portion swollen on one side and partly translucent (combined sections 1.36 mm long). Free oviduct very narrow and short (0.35 mm). Vagina long (1.1 mm) and oval. Spermathecal duct over twice width of free oviduct tapering to a fine tube that runs adjacent to spermoviduct terminating in a small oval sac (0.43 mm long) lying partly over a coil of intestine. Penis (1.6 mm long) of two equal parts: a solid proximal section, sausage shaped, squeezed near centre making the top piece lean over and a distal section consisting of a tube with two minor bulges leading to the atrium. Epiphallus a narrow tube over half penis length, enters apically close to retractor muscle. Kidney bilobed, pericardial segment stronger. Stringy white pigmentation along stomach and over albumen gland and proximal section of spermoviduct. (Based on three dissections: N02 110479 near Maukins Nook, 2.4 mm x 1.2 mm, R.P. 16/3/88, AK152172; N02 048499 Poroiki Hill, 2.4 mm x 1.3 mm, R.P. 18/3/88, AK152173; N02 960455 Kohuronaki, 2.7 mm x 1.4 mm, B.H. & O.J. Marston 4/6/96, M.124280).

## REMARKS

The section of the vas deferens that arises from the spermoviduct contained many folds on the Maukins Nook specimen but was straight for Poroiki Hill specimens. The dissected Kohuronaki specimen had a slightly shorter vagina and longer oviduct which made the base



Figs 41-48. Shell and anatomy of *Climocella runga* n. sp. Scale lines 43,48 = 1 mm, 41,42,44-47 = 0.5 mm. Abbreviations as for Figs 1-8. 41. Terminal genitalia. 42. R.H. view of genitalia. 43. Pallial cavity and kidney. 44. Hermaphrodite duct. 45. Spermathecal sac and heart. 46. Stomach and ovotestis. 47. Ovotestis. 48. Shell of holotype (AK72902).



of the spermathecal duct very much larger and more dominant than the free oviduct from which it diverged quite strongly. Shell differences were noted at all sites with variations particularly noted in rib density, angle of ribs from suture and strength of microscopic spirals. The anatomical differences were not associated with distinct shell form and they did not appear to be regionally based. I considered them as intraspecific. *C. runga* is generally smaller than *C. reinga* and always has a depressed spire. Colour of fresh specimens, an angled rib, low strength of microscopic spirals, and expanded final whorl are other differentiating features. On the evidence to date this is not a common snail and was evidently overlooked in the past. No preserved material was available from the type locality.

TYPE LOCALITY: Unuwahao summit, in litter on south side, steep with thick kiekie. N02 008521.

HOLOTYPE: AK72902, 2.4 mm x 1.3 mm, J.G. 10/5/91.

PARATYPES: AK72924, Unuwahao N02 017518, P.M. 1/5/82 (3); AK72903, type locality, J.G. 10/5/91 (2); M.129907, type locality J.G. 10/5/91 (2).

#### OTHER MATERIAL EXAMINED

Kohuronaki N02 966448, M.79617, N02 968450, M.79664, G. Carlin 1/7/84; N02 958458, P.M. 1/5/85; N02 960455, M.124281, N02 958459, M.124287 M.124288 (whole organism) B.H. & O.J. Marston 4/6/96. Pandora M02 894492, P.M.1/5/85, M.82080 AK152023. Poroiki Hill N02 048499, P.M. 1/3/88, AK152022. Radar Bush M02 897476, P.M. 1/4/83, M.129906 AK152010; M02 896476, P.M. 1/3/88, AK152019. Tapotupotu track M02 879484, P.M. 1/3/88, AK152004; Tom Bowling Bay N02 075519, P.M. 1/10/86, M.97204; N02 073519, P.M. 1/5/85, M.82062; N02 075520, P.M. 1/10/86, AK152014. Unuwahao N02 012524, P.M. 1/4/83, M.79370 AK152014; N02 008521, J.G. 10/5/91, AK9716; N02 007526, B.H. & O.J. Marston, M.124282. Waihi Str. N02 005527, J.G. 10/5/91, AK151865. Waterfall Gully N02 990524, N. Douglas 2/10/75, AK151864.

#### DISTRIBUTION

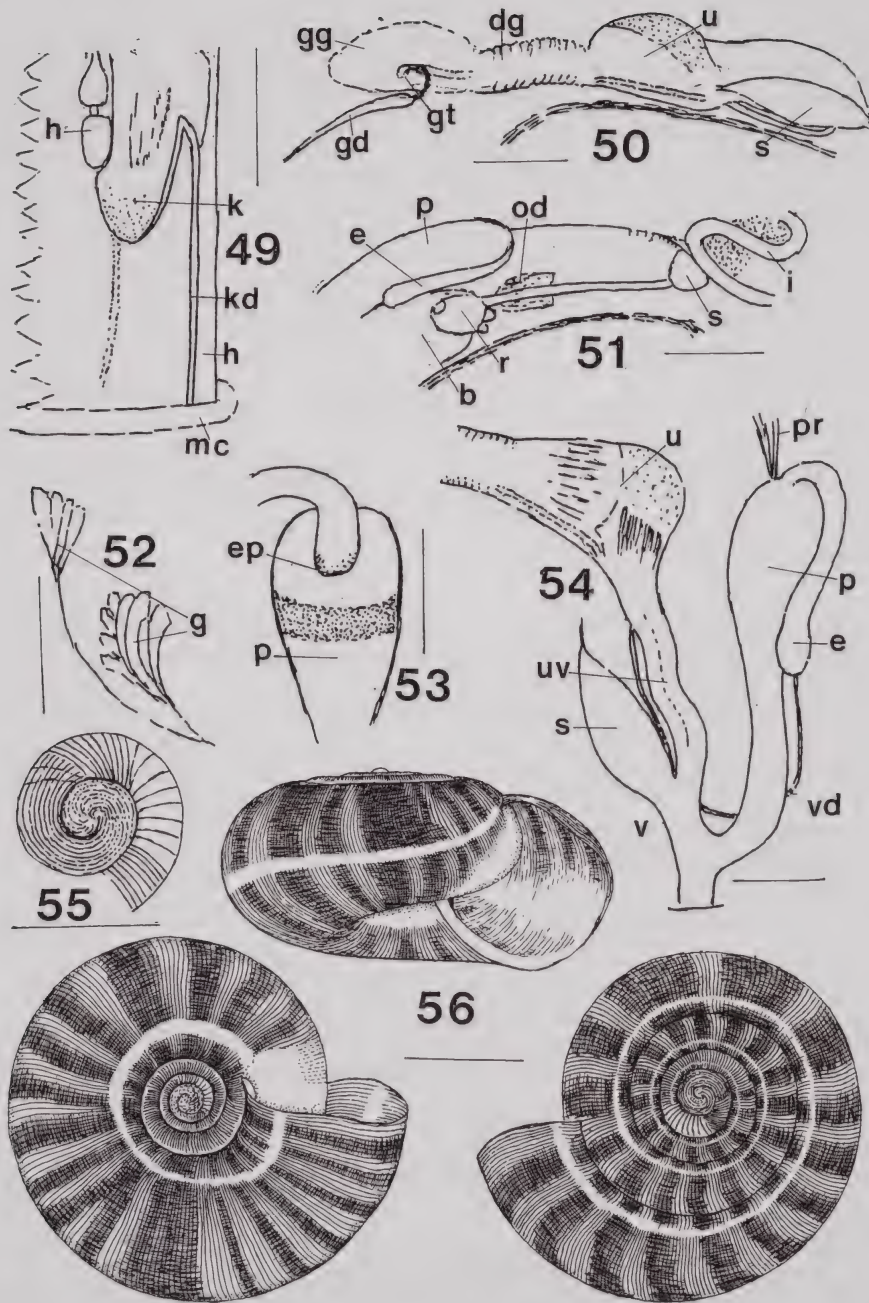
*C. runga* was collected from Pandora east to Maukins Nook and south to Kohuronaki. It is apparently endemic to the Te Paki region. The species seems to prefer the higher altitude sites with thick forest cover, the greatest numbers being found on Unuwahao and Kohuronaki.

#### *Climocella waenga* n. sp. Figs 49-56, 57

ETYMOLOGY: Taken from the Maori place name, *waenga* = middle.

#### DESCRIPTION

Shell small (up to 3.1 mm x 1.6 mm), subdiscoidal, four and a half regularly increasing whorls. Last whorl and umbilicus 0.27 and 0.25 respectively of total shell width. Spire slightly raised. Protoconch one and three quarter whorls; first whorl with eight spiral lirae; next half with crowded oblique axials (c. 25), first widely spaced, all crossed by spirals; last quarter with 22 widely spaced straight axials (27 per mm). Teleoconch whorls have close, broad based, rounded axial ribs (105 on first, 31 per mm on final whorl) with one or two fine secondary



Figs 49-56. Shell and anatomy of *Climocella waenga* n. sp. Scale lines 49,56 = 1 mm, 50-55 = 0.5 mm. Abbreviations as for Figs 1-8. 49. Pallial cavity and kidney. 50. R.H. view of genitalia. 51. L.H. view of genitalia. 52. Ovotestis. 53. Apical section of penis. 54. Terminal genitalia. 55,56. Shell and protoconch of holotype (AK72904).

axials in the narrow space between. These axials emerge at right angles from a moderately deep suture and are sinuous over the shell surface. The whole teleoconch plus the last quarter of the protoconch is overlaid with fine dense microscopic spiral lirae. Colour consists of variable bands of russet (pl.15 13k R.C.S.) on a cartridge buff (pl 30 19f R.C.S.) background covering the whole shell. The lighter bands are narrow, the shell is predominantly russet. (Based on the holotype.)

Ovotestis comprising two fan shaped clusters of alveoli (0.45 mm long) with digestive gland tissue between placed just beyond apex of stomach. Hermaphrodite duct emerging as a fine tube from ovotestis slowly enlarging for 0.8 mm at distal end, then reducing sharply to a narrow tube terminating in the carrefour with diverticulate spherical talon partly embedded in the albumen gland. Albumen gland under loops of intestine with hermaphrodite gland entering centrally. Proximal section of spermooviduct (0.6 mm long) containing the prostatic alveoli. Distal section (1 mm long) enlarged along one side with a semi-transparent bulge. Free oviduct long (0.6 mm) moderately wide. Thickened base of spermathecal duct oval before tapering to a fine tube; spermathecal sac (0.47 mm long) pear shaped, rests against loop of intestine. Vagina a short thick tube about same width as distal end of penis. Penis (1.95 mm) a long tube the proximal half expanded with a noticeable thick ring above the middle. Retractor muscle attached to penis apex alongside entry of epiphallus. Epiphallus half length of penis, protruding into it a little. Kidney bilobed, limb overlying rectum small. Some black pigmentation on the pallial cavity wall over the pericardial lobe and along the ureter. (Based on two dissections from Waenga, 3 mm x 1.5 mm and 2.7 mm x 1.4 mm, G.B. 16/9/92, AK152174 and one from Te Koau, 2.2 mm x 1.3 mm, G.B. 23/9/92, AK152175.)

#### REMARKS

The description above relates primarily to the larger snail from Waenga, the smaller had a relatively longer epiphallus (0.6 of penis length) and the thickening of the proximal penis wall was replaced by a slight restriction. The specimen from Te Koau was juvenile with only the penis developed, though small. *C. waenga* has not been found in sympatry with *C. intermedia* with which it might be confused on shell character. *C. waenga* is larger, darker coloured and has a smaller umbilicus. It is the most highly coloured of all the species of *Climocella* described so far.

TYPE LOCALITY: Waenga, Y14 653915, alt. 100 m.

HOLOTYPE: AK72904, 3.1 mm x 1.6 mm, P.M. 1/3/93.

PARATYPES: All from type locality. AK72905, P.M. 1/3/93 (7); M.129908 P.M. 1/3/93 (7).

#### OTHER MATERIAL EXAMINED

Hicks Bay Z14 771901, G.B. 20/9/92, AK151770; Z14 769901, P.M. 1/3/93, AK151763; Z14 774900, P.M. 1/3/93, AK151744. Hikurangi Y15 656581, P.M. 1/12/80, AK151784. Hikurangi Gate Str. Y15 562593, F.C. 5/12/83, M.78104. Lottin Bay Y14 621896, D.R. 10/7/78, M.104461; Y14 653913, R. Prasad & J. Kenny 11/4/95, AK96750. Otanga Y14 664922, P.M. 1/3/93, AK151759. Rangiatea Z14 762986, G.B. 20/9/92, AK151767. Raukumara S.F. Y14 707697, P.M. 1/6/87 AK151866. Te Araroa Z14 852828, P.M. 1/12/80, AK151922. Te Araroa - Hicks Bay Z14 783865, N. Douglas 1/4/77, AK85674; Z14 778867, N. Douglas 9/4/77, AK151766. Te Koau Z14 778864, P.M. 1/3/93,

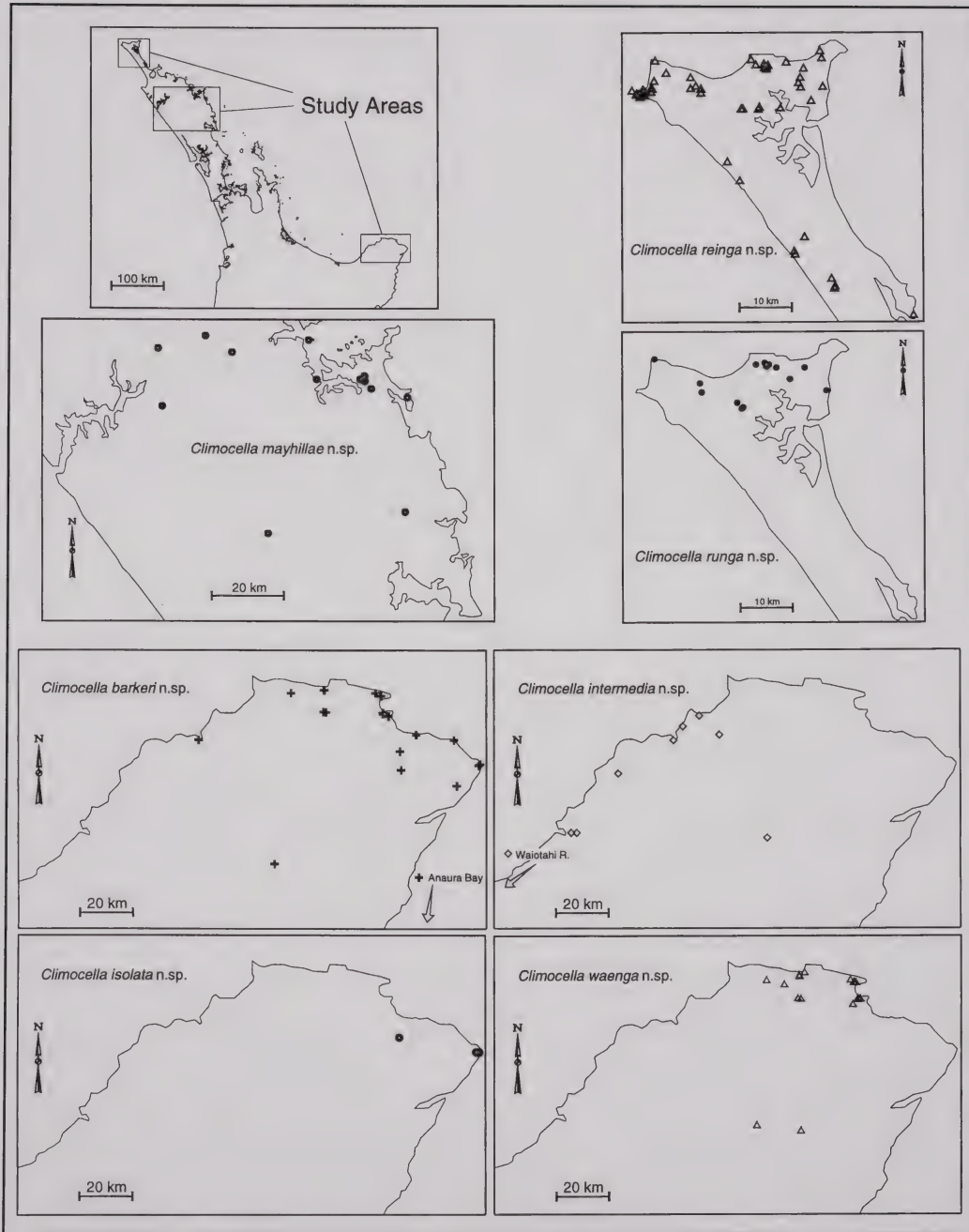


Fig 57. Maps showing distribution of locality records of the seven species of *Climocella* from northern New Zealand described in this paper.

AK151805; Z14 767853, P.M. 1/3/93, AK151756; Z14 782865, G.B. 23/9/92, AK151769. Te Rereauria Y14 583905, P.M. 1/9/92, AK151782. Waenga Y14 653913, P.M. 1/9/92, AK151762; Y14 653915. P.M. 1/9/92, AK151750; Y14 653915, P.M. 1/3/93, AK151743. Waiaroho Y14 650866, G.B. 23/9/92, AK151768; Y14 656865, P.M. 1/3/93, AK151752.

#### DISTRIBUTION AND HABITAT

Known from the area between Cape Runaway and East Cape, south to the Mt. Hikurangi area. The species is commonly associated with tree ferns and occurs inside rotting tree fern trunks in the fine tilth (P.M., pers. comm.).

#### DISCUSSION

The descriptions of the seven species in this paper considerably broaden the concept of genus *Climocella*. *C. maculata* in the south and *C. akarana* in the north are wide ranging, but the other species known to date have more restricted distributions. Patterns of anatomy are emerging particularly for the colour-patterned species. All the anatomies of the coloured species studied suggest a monophyletic lineage. It seems necessary in this genus to view the animal before being absolutely certain as to the identity of the shell. Further descriptions of new species, and extensions of range of known species will appear only slowly as preserved animal material becomes available. In this regard since my last paper (Goulstone 1996) I gathered live *C. maculata* from the type locality, Mt. Cook, Governors Bush, AK152176, dissection of which confirmed the anatomy drawn of a specimen from Pongaroa, Hawkes Bay. The Mt. Cook specimens had some black pigmentation over the pallial cavity which was not shown in those from Pongaroa, preserved from 1970, otherwise they were the same. It is regrettable that the genus is unfolding in such a piecemeal fashion and full ranges of species cannot be ascertained but it seems preferable to record information that comes to hand, rather than await the full picture.

*Acknowledgements.* I have gathered very little of the raw material for this paper myself and would particularly thank the following who supplied live or preserved animals: Fred Brook, Gary Barker, Dr Frank Climo, Bruce Hazelwood and John Marston, Pauline Mayhill, Richard Parrish, Peter Poortman. P. Mayhill also supplied much habitat information and together with G. Barker read the manuscript and made many necessary corrections. I am also indebted to Bruce Marshall and Karin Mahlfeld from the Museum of New Zealand for access to that collection and Dr Bruce Hayward and the staff of the Auckland Museum Marine Department for much support. Dr Hugh Grenfell produced the distribution maps.

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